Parvovirose – zwischen Vergangenheit und Zukunft

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Fachtierärztin für Innere Medizin der Kleintiere

Aktuelle Fragen – CPV und Zukunft

- Weiterhin Relevanz einer Infektion mit Parvoviren in Deutschland?
- Virusmutation – Einfluss auf Diagnostik, Therapie und Impfung?
- Neue Behandlungsmöglichkeiten?
- Impfung vs. Titerbestimmung?
- Vollständige Genesung oder „bleibt was zurück“?

Symptome Hund

zwei Symptomkomplexe

- Canine Parvovirus-Enteritis
  - Häufig
  - Ungeschütze Hunde allen Alters (Welpen!!!)

- Parvovirus-Myokarditis
  - Mittlerweile extrem selten
  - Bei Infektion von Feten oder Neonaten (bis ca. 4. Lebenswoche)

Typische Todesursachen

Mortalitätsrate bis zu 90 % (unbehandelt)

- Dehydratation/hypovolämischer Schock
- Sepsis
- (Invagination)

Diagnostik – Qual der Wahl

- Direkter Erregernachweis:
  - Ganzes Parvovirus
  - CPV-Antigen
  - CPV-DNA
- Indirekter Erregernachweis: Antikörper (AK)
- Sektion

Antigen-Schnelltests

Schnelltest	Meth.	Sens./Spez. (Hst.)	Sens. (Vgl. PCR)	Spez. (Vgl. PCR)
SNAP® Parvo Test (Idexx)	ELISA	100/100 %	18-82 %	100 %
Witness® Parvo Card (Zoetis)	IC	100/95 %	26 %	95 %
FASTest® Parvo Card (Megacor)	IC	97/100 %	16 %	100 %
Fassisi® ParCo (Fassisi)	IC	92/95 %	?	?

Schmitz et al., 2009; Markovich et al. 2012; Proksch et al., 2015

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Fassisi® ParCo (Fassisi)	IC	92/95 % (ELISA)	?	?

Schmitz et al., 2009; Markovich et al. 2012; Proksch et al., 2015

Vergleich Ag-Tests vs. PCR

Studie mit 150 Hunden

- Gruppe H: gesunde Hunde („healthy“), Median 5J
- Gruppe S: Tierheim Hunde („shelter“), Median 7 J
- Gruppe P: V.a. Parvovirus-Infektion, Median 3 Mo

Design:

- Vergleich 8 Ag-Tests („Schnelltests“, POCT) mit quant. PCR
- Virusanzucht der PCR-positiven

Walter-Weingärtner et al., 2021

Vergleich Ag-Te

Studie mit 150 Hunder

- Gruppe H: gesunde — Median 5J
- Gruppe S: Tierheim — Median 7 J
- Gruppe P: V.a. Parv — edian 3 Mo

Design:

- Vergleich 8 Ag-Test — OCT) mit quant. PCR
- Virusanzucht der P

POCT	Product
POCT-A	Snap® Parvo
POCT-B	Fassisi® Parvo
POCT-C	Primagnost® Parvo H + K
POCT-D	FASTest® PARVO Card
POCT-E	Vetexpert Rapid Test CPV Ag®
POCT-F	Anigen Rapid CPV Ag Test Kit®
POCT-G	ImmunoRun® Parvovirus Antigen Detection Kit
POCT-H	WITNESS® Parvo

Walter-Weingärtner et al., 2021

Vergleich Ag-Tests vs. PCR

Anteil PCR-positiver Kotproben: 47 % (70/150)
Gruppe P: 98 % (49/50)

Aber:
Gruppe H: 24 % (12/50)
Gruppe S: 18 % (9/50)

Ø Kotviruslast:

- $5{,}3 \times 10^{13}$/g Kot Gruppe P
- $2{,}4 \times 10^{6}$/g Kot Gruppe H und $2{,}7 \times 10^{6}$/g Kot Gruppe S

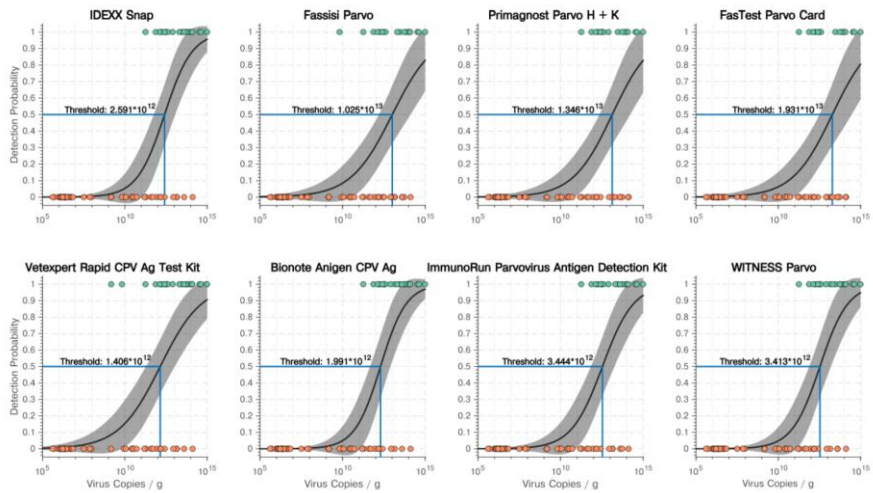
Walter-Weingärtner et al., 2021

Vergleich Ag-Tests vs. PCR

Tests	POCT-A	POCT-B	POCT-C	POCT-D	POCT-E	POCT-F	POCT-G	POCT-H
Tests difficult to interpret % (number of tests/total)	1.3 (2/150)	2.0 (3/150)	0.0 (0/150)	0.0 (0/150)	2.7 (4/150)	3.3 (5/150)	1.3 (2/150)	0.7 (1/150)
Sensitivity % (95% CI)	31.4 (24.2–39.5)	25.7 (19.1–33.5)	24.3 (17.8–32.0)	22.9 (16.6–30.5)	34.3 (26.9–42.5)	32.9 (25.5–41.0)	30.0 (22.9–38.1)	30.0 (22.9–38.1)
Specificity % (95% CI)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)	100.0 (96.9–100)

	Tests	POCT-A	POCT-B	POCT-C	POCT-D	POCT-E	POCT-F	POCT-G	POCT-H
Group H real-time PCR-positive: 24.0% (12/50) mean virus load: 2.4×10^6	Sensitivity %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Specificity %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Group S real-time PCR-positive: 18.0% (9/50) mean virus load: 2.7×10^6	Sensitivity %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Specificity %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Group P real-time PCR-positive: 98.0% (49/50) mean virus load: 5.3×10^{13}	Sensitivity %	44.9	36.7	34.7	32.7	49.0	46.9	42.9	42.9
	Specificity %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Walter-Weingärtner et al., 2021



Walter-Weingärtner et al., 2021

Schnelltests

Ursachen der niedrigen Sensitivität?

- Einfluss durch unterschiedliche Virusstämme? => NEIN
- Zeitpunkt Test?
- Einfluss der Kotkonsistenz/geringe Viruslast im Kot?
- Vorhandensein von fäkalen AK?

=> Bei klinischem Verdacht und negativem Schnelltest-Ergebnis: Nachuntersuchung mit PCR!

Impfung & Diagnostik

Modifizierte Lebendvakzine (MLV):

- Virämie
- Fäkale Ausscheidung von Impfvirus
- Nachweis von Impfvirus in Gewebe (Milz, Lymphknoten, Darm)

Interferenz mit Testverfahren => falsch-positive Testergebnisse

Aber:

Geimpfte kranke Hunde sign. höhere ct-Werte als ungeimpfte (27 vs 18)

Decaro et al., 2007; Day et al., 2010; Decaro&Buonavoglia, 2017; Freisl et al., 2017, Yip et al., 2020, Schiro et al., 2022

MLV – Virämie und Ausscheidung

100 gesunde Hunde, Median 5 J, „adäquate Impfung“ (aktuelle StiKovet)

- 23 % der Hunde mit Ausscheidung d3-d28
- 11/23 shedding d21 (Ø $6x10^4$ Kopien/g Kot)
- Peak Viruslast d3 ($3,6x10^6$/g Kot)

26 Welpen mit CPV-2 und CPV-2b-Impfstoff

- Virämie ab Tag 3, bis 21/24 Tage, Peak Tag 7/10
- Virusausscheidung PCR: $3,8x10^5$/µl bzw. $1,1x10^6$/µl (insg. ca. 3 Wo)
- Ausscheidung: keine Probe positiv in POCT und HA

Decaro et al., 2014, Freisl et al., 2017

Impfung & Diagnostik

PCR mit MGB-Technik:

Sichere Differenzierung zwischen Impf- und Feldvirus (auch neue „2b-Impfstoffe“)

Interferenz zwischen Impfung und Schnelltests?

Decaro et al., 2007; Day et al., 2010; Decaro&Buonavoglia, 2017; Freisl et al., 2017

Impfung & Schnelltests

- SNAP® Parvo Test: kein Nachweis von Impfvirus *(Hersteller, Schulz 2008)*
- Wittnes® Parvo Card:
  - Risiko falsch positiver Ergebnisse bis 10 Tage nach Impfung (Hersteller)
  - Kein Nachweis von Impfvirus *(Decaro et al., 2014)*

Diskussion:

Zu niedrige Sensitivität der Schnelltests für Nachweis von Impfvirus-Last…

Diagnostik und Interferenz mit Impfung:

Effekt Impfung auf Diagnostik

- Kein Nachweis von Impfvirus im Schnelltest
- Geimpfte kranke Tiere signifikant seltener positiv im Schnelltest als ungeimpfte (22 % geimpfte vs. 64 % geimpfte)
- Geimpfte kranke Hunde signifikant höhere ct-Werte als ungeimpfte (27 vs 18)

Yip et al., 2020

Diagnostik - Probennahmeort

Einfluss des Entnahmeorts auf PCR-Ergebnisse

- Vergleich PCR aus Blut und Abstrichen Pharynx & Rektum
- Vergleich an 4 Hundegruppen:
  - Welpen mit Infektion CPV
  - Welpen mit GIT aber andere Ursache als CPV
  - Gesunde Welpen (Proben vor und nach Welpenimpfungen)
  - Gesunde Adulte mit hohem Infektionsdruck vor und nach Impfung

Segev et al., 2021

Virusnachweis (PCR)

Welpen mit CPV-Infektion:

- Nachweis Virus 95 % Blut, 98 % Pharynx, and 88 % Rektum
- Negative Korrelation Viruslast und Symptomdauer

Gesunde Welpen vor und nach Impfung:

- 10 d nach 1. Impf: 31 % Blut, 12 % Pharynx, 62 % Rektum
- 20 d nach 1. Impf: 19 % Blut, 0 % Pharynx, 0 % Rektum
- 12 & 28 d nach 2. Impf: 6 % Blut, 0 % Pharynx & Rektum

- Adulte Hunde: alle negativ (??)

Segev et al., 2021

Virusnachweis (PCR)

W
- ➢
- ➢

Ge
- ➢
- ➢
- ➢

CPV: fäkale Aussscheidung im Median 46 Tage (Peak 10 Tage post Infektion)

Neue Fragestellung:
- Kot-Proben weniger sensibel als Pharynxtupfer?
- Vorteil Probennahme Pharynx bei bereits geimpften kranken Welpen?

=> Weitere Studien nötig!

- ➢ Adulte Hunde: alle negativ (??)

Segev et al., 2021

Therapie

- ➢ Ausgleich Flüssigkeitsdefizit und Elektrolytverschiebungen
  - Kristalloide Lösungen
  - Kolloide Lösungen
- ➢ Prävention/Therapie der Sepsis, ggf. auch DIC
- ➢ Antiemesis und Magenschutz
- ➢ Schmerzmittel
- ➢ Ernährung und Supplementation
- ➢ Immuntherapie

Goddard&Leisewitz, 2010, Mazzaferro 2020

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Goddard&Leisewitz, 2010, Mazzaferro 2020

Kottransplantation

Received: 4 August 2017 | Revised: 21 December 2017 | Accepted: 18 January 2018
DOI: 10.1111/jvim.15072
STANDARD ARTICLE
Journal of Veterinary Internal Medicine Open Access ACVIM American College of Veterinary Internal Medicine

Fecal microbiota transplantation in puppies with canine parvovirus infection

Giorgio Q. Pereira[1] | Lucas A. Gomes[1] | Iago S. Santos[1] | Alice F. Alfieri[2] | J. S. Weese[3] | Marcio C. Costa[4]

- Symptomatische Therapie +/- FMT
- 62 % (FMT) vs. 5 % normale Kotkonsistenz innerhalb 48 Std.
- Signif. kürzere Hospitalisierung (3 vs. 6. Tage), Mortalität 21 % (FMT) vs. 36 % (nicht signif.)

Immunmodulation

Medizinische Kleintierklinik

Therapie-Optionen

- Paramunitätsinducer (Zylexis®)
- Hyperimmunserum (Feliserin®)
- Immunplasma
- Rekombinantes felines Interferon-omega

Zylexis®

Medizinische Kleintierklinik

Vet J. 2014 Nov;202(2):340-7. doi: 10.1016/j.tvjl.2014.08.012. Epub 2014 Aug 15.

Efficacy of the paramunity inducer PIND-ORF in the treatment of canine parvovirus infection.

Proksch AL[1], Unterer S[2], Truven U[3], Hartmann K[2].

⊕ **Author information**

Abstract

Canine parvovirus (CPV) infection is a common and severe disease particularly affecting young dogs. The paramunity inducer PIND-ORF is reported to stimulate the innate immune system and, if used as a supplementary medication, might lead to a more rapid improvement in clinical signs in dogs with CPV infection. The aim of this study was to evaluate the efficacy of PIND-ORF in dogs with CPV infection in a prospective, placebo-controlled, double-blinded trial using 38 dogs randomly assigned to two groups. Inclusion criteria were clinical signs consistent with CPV infection and a positive faecal CPV PCR. Dogs received either PIND-ORF (n = 20) or placebo (n = 18) and additional symptomatic treatment. Time to recovery and mortality rate were compared between the two groups. Clinical signs, complete blood counts (CBC), and serum protein and albumin concentrations were evaluated daily during hospitalisation and on day 14. Viral shedding and antibody titres were measured by faecal CPV PCR and serum neutralisation assay. There was no significant difference in time to recovery, clinical signs, blood parameters, duration of virus shedding, and antibody titres between the two groups. The only significant difference was an increase in lymphocyte counts and antibody titres observed in the PIND-ORF group only. Three dogs receiving placebo did not survive, but the mortality rate was not significantly different between groups (P = 0.097). No significant effect of PIND-ORF on recovery and outcome could be demonstrated.

KEYWORDS: Canine parvovirosis; Clinical trial; Dog; Innate immunity; Parapoxvirus ovis

PMID: 25218850 DOI: 10.1016/j.tvjl.2014.08.012

Zylexis®

Medizinische Kleintierklinik

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Kein therapeutischer Effekt auf Heilungsverlauf und Mortalitätsrate

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PMID: 25218850 DOI: 10.1016/j.tvjl.2014.08.012

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Medizinische Kleintierklinik

J Small Anim Pract. 2017 Mar 31. doi: 10.1111/jsap.12676. [Epub ahead of print]

Efficacy of feline anti-parvovirus antibodies in the treatment of canine parvovirus infection.

Gerlach M[1], Proksch AL[1], Unterer S[1], Speck S[2], Truyen U[2], Hartmann K[1].

⊕ Author information

Abstract

OBJECTIVE: This prospective, randomised, placebo-controlled, double-blinded study aimed to evaluate efficacy of commercially available feline anti-parvovirus antibodies in dogs with canine parvovirus infection.

METHODS: First, cross-protection of feline panleukopenia virus antibodies against canine parvovirus was evaluated in vitro. In the subsequent prospective clinical trial, 31 dogs with clinical signs of canine parvovirus infection and a positive faecal canine parvovirus polymerase chain reaction were randomly assigned to a group receiving feline panleukopenia virus antibodies (n=15) or placebo (n=16). All dogs received additional routine treatment. Clinical signs, blood parameters, time to clinical recovery and mortality were compared between the groups. Serum antibody titres and quantitative faecal polymerase chain reaction were compared on days 0, 3, 7, and 14.

RESULTS: In vitro, canine parvovirus was fully neutralised by feline panleukopenia virus antibodies. There were no detected significant differences in clinical signs, time to clinical recovery, blood parameters, mortality, faecal virus load, or viral shedding between groups. Dogs in the placebo group showed a significant increase of serum antibody titres and a significant decrease of faecal virus load between day 14 and day 0, which was not detectable in dogs treated with feline panleukopenia virus antibodies.

CLINICAL SIGNIFICANCE: No significant beneficial effect of passively transferred feline anti-parvovirus antibodies in the used dosage regimen on the treatment of canine parvovirus infection was demonstrated.

PMID: 28369886 DOI: 10.1111/jsap.12676

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Immunplasma

Medizinische Kleintierklinik

Clinical evaluation of a single dose of immune plasma for treatment of canine parvovirus infection

Ryan F. Bragg, DVM, MS, DACVECC; Amanda L. Duffy, DVM, MS, DACVECC; Frank A. DeCecco, DVM; Donald K. Chung, DVM; Maura T. Green; Julia K. Veir, DVM, PhD, DACVIM; Steven W. Dow, DVM, PhD, DACVIM

Objective—To evaluate the efficacy of administration of a single 12-mL dose of canine parvovirus (CPV)-immune plasma for treatment of CPV enteritis.

Design—Prospective, randomized, double-blinded, placebo-controlled clinical trial.

Animals—14 dogs with naturally occurring CPV enteritis.

Procedures—Dogs were assigned to treatment groups on the basis of randomization tables and were administered a single IV dose of CPV-immune plasma (treatment group) or an equivalent volume of saline (0.9% NaCl) solution (placebo group) within 18 hours after admission to the hospital. Treatment and outcome variables evaluated included neutrophil, monocyte, and CPV counts; number of days of hospitalization; changes in body weight; and cost of treatment.

Results—When dogs treated with CPV-immune plasma were compared with dogs treated with saline solution, there were no significant differences detected among neutrophil or monocyte counts, magnitude of viremia, weight change, number of days of hospitalization, or cost of treatment.

Conclusions and Clinical Relevance—Administration of a single 12-mL dose of immune plasma soon after the onset of CPV enteritis in dogs was not effective in ameliorating clinical signs, reducing viremia, or hastening hematologic recovery. (*J Am Vet Med Assoc* 2012;240:700–704)

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rf-IFNω

Medizinische Kleintierklinik

- (Schnelle) Reduktion der Schwere der Symptome
- Signifikant ↓ Mortalitätsrate
- ↓ Hospitalisierungsdauer

Ishiwata et al., 1998; Martin et al., 2002; de Mari et al., 2003

Konsequenzen einer Parvovirose

RESEARCH ARTICLE

PLoS ONE, 2018

Long-term effects of canine parvovirus infection in dogs

Elena Kilian[1]*, Jan S. Suchodolski[2], Katrin Hartmann[1], Ralf S. Mueller[1], Gerhard Wess[1], Stefan Unterer[1]

- 42 % Parvo vs. 12 % Kontrollen mit chronisch GIT
- Beginn der Symptome im 1. Lebensjahr bei 83 %
- 63 % mit FRE, 60 % mit Symptomen bei Futter- oder Medikamentenwechsel

=> ↑ Risiko einer chron. Darmerkrankung (FRE)

Wichtig: Prävention

CPV-Impfung: core-Impfung

Grundimmunisierung:

- Welpenimpfungen bis nach 16. LW
- Booster mit 15 Monaten => erst dann vollständige Grundimmunisierung!

Booster-Impfung

- Hohe Prävalenz anti-CPV-AK in der Population
- Sehr lange Immunität nach Impfung

=> Booster nach Bedarf oder alle 3 Jahre (unabh. von Hersteller)

Böhm et al., 2005, Riedl et al., 2015, Impfleitlinien StiKo vet 2023

Impfversagen/Impfversager

Impfstoff-assoziiertes Versagen:

- Lagerung
- Applikationsort/Händling
- Impfstämme (CVP-2c !?) und Dosis

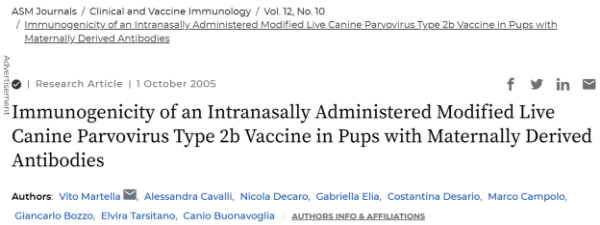
Impfversagen/Impfversager

Patienten-assoziiertes Versagen

- Maternale AK (maternally derived antibodies, MDA)!!!
- Genetische Faktoren (non- und low-responder)
- Chronische Krankheiten/Immunsuppression
- Alter (geriatrische Patienten; Haupt„problem“: Welpen)
- Mikrobiom und enterale Parasiten
- Ggf. Stress (langanhaltend)

„Durchbruch“ durch MDA-Barriere

- Impfstoffe mit „high titer“-Impfstoffen
- Alternative Applikationsformen in der Zukunft?
  - Nasale Verabreichung
  - Orale Verabreichung



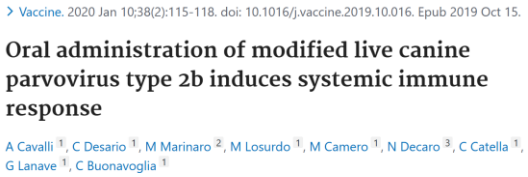
ASM Journals / Clinical and Vaccine Immunology / Vol. 12, No. 10
/ Immunogenicity of an Intranasally Administered Modified Live Canine Parvovirus Type 2b Vaccine in Pups with Maternally Derived Antibodies

Advertisement

| Research Article | 1 October 2005

Immunogenicity of an Intranasally Administered Modified Live Canine Parvovirus Type 2b Vaccine in Pups with Maternally Derived Antibodies

Authors: Vito Martella, Alessandra Cavalli, Nicola Decaro, Gabriella Elia, Costantina Desario, Marco Campolo, Giancarlo Bozzo, Elvira Tarsitano, Canio Buonavoglia | AUTHORS INFO & AFFILIATIONS



› Vaccine. 2020 Jan 10;38(2):115-118. doi: 10.1016/j.vaccine.2019.10.016. Epub 2019 Oct 15.

Oral administration of modified live canine parvovirus type 2b induces systemic immune response

A Cavalli [1], C Desario [1], M Marinaro [2], M Losurdo [1], M Camero [1], N Decaro [3], C Catella [1], G Lanave [1], C Buonavoglia [1]

Impfdurchbrüche/Reaktivierung

- Impfung grundsätzlich nur bei gesunden Hunden
- MLV nicht bei:
  - Trächtigkeit
  - Welpen < 4. LW
  - Immunsuppression

Aber:

Aktuell kein Beweis für Reaktivierung, auch nicht bei Immunsuppression

Bergmann et al., 2021+21, Impfleitlinien StiKo vet 2023

Impfung/Diagnostik & kranker Welpe

Nach Studienlage kein Nachweis von „Impfdurchbrüchen“ oder Reaktivierung von Impfvirus

Stattdessen:

Nachweis von simultaner Infektion mit Feldvirus oder anderen Darmpathogenen im Impfzeitraum

=> Noch fehlender Impfschutz gegen CPV

=> Infektion mit anderen Erregern (Erregersuche!)

Decaro et al., 2007

Antikörper-Titerbestimmung

Goldstandard

- Hämagglutinationshemmtest
- Serumneutralisationstest/Virusneutralisationstest

=> Numerische Titerangaben

Nutzung:

v.a. für Zeitpunkt Welpenimpfungen (cave „fraternale“ Titerbestimmung)

Vergleich AK-Schnelltests

Point-of-Care Tests	ImmunoComb®	TiterCHEK®	FASTest®	CanTiCheck®
Results in sera of all 241 dogs (client-owned dogs and specific pathogen free dogs) (prevalence of antibodies in virus neutralization: 80%)				
Sensitivity [1] % (95% CI [2] %)	70 (63–77)	63 (56–70)	95 (91–98)	80 (74–86)
Specificity [3] % (95% CI [2] %)	94 (83–99)	96 (86–100)	73 (59–85)	98 (89–100)
Positive predictive value [4] % (95% CI [2] %)	98 (94–100)	98 (94–100)	93 (89–96)	99 (96–100)
Negative predictive value [5] % (95% CI [2] %)	45 (35–55)	40 (31–49)	80 (65–90)	56 (45–67)
Overall accuracy [6] % (95% CI [2] %)	75 (69–80)	70 (63–75)	91 (87–94)	84 (79–88)
Results in sera of 198 client-owned dogs (prevalence of antibodies in virus neutralization: 97%)				
Sensitivity [1] % (95% CI [2] %)	70 (63–77)	63 (56–70)	95 (91–98)	80 (74–86)
Specificity [3] % (95% CI [2] %)	50 (12–88)	67 (22–96)	33 (4–78)	83 (36–100)
Positive predictive value [4] % (95% CI [2] %)	98 (94–100)	98 (94–100)	98 (95–99)	99 (96–100)
Negative predictive value [5] % (95% CI [2] %)	5 (1–14)	5 (1–13)	18 (2–52)	12 (4–25)
Overall accuracy [6] % (95% CI [2] %)	70 (63–76)	63 (56–70)	93 (89–96)	80 (74–86)
Results in sera of 43 specific pathogen free dogs (prevalence of antibodies in virus neutralization: 0%)				
Sensitivity [1] % (95% CI [2] %)	n.d. [7]	n.d. [7]	n. d. [7]	n.d. [7]
Specificity [3] % (95% CI [2] %)	100	100	79 (64–90)	100
Positive predictive value [4] % (95% CI [2] %)	n.d. [7]	n.d. [7]	n.d. [7]	n.d. [7]
Negative predictive value [5] % (95% CI [2] %)	100	100	100	100
Overall accuracy [6] % (95% CI [2] %)	100	100	79 (64–90)	100

[1] Sensitivity, true positive rate; [2] CI, confidence interval; [3] specificity, true negative rate; [4] positive predictive value, proportion of patients with positive test results in total of subjects with positive results; [5] negative predictive value, proportion of patients with negative test results in total of subjects with negative results; [6] overall accuracy, probability that a dog was correctly classified by the tests; [7] n.d., cannot be determined.

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Schlussfolgerungen

- Sicherung der Diagnose, cave negative Ag-Schnelltests
- Intensive symptomatische Therapie
- Immunmodulation ohne erkennbare Vorteile; Ausnahme: Interferon
- Wichtigste Maßnahme: Prävention => core-Vakzine
- Titerbestimmungen statt regulärer Booster-Impfungen

Vielen Dank! Fragen?